

Claims

What is claimed is:

- 1 1. A system for reducing particulate emissions from an internal combustion engine
2 comprising:
3 at least one particulate control device,
4 at least one inlet pipe bring exhaust from the engine to the particulate control
5 device,
6 at least one outlet pipe coupled to an outlet on the particular control device,
7 piping to connect the engine and inlet pipe,
8 means for regenerating the particulate control device in place while the engine is
9 not operating,
10 means for determining if the engine is operating, and
11 control means to start the means for regenerating, after the engine has stopped
12 running.
- 1 2. The system of Claim 1 wherein the means for regenerating comprises an electric
2 heater, air pump, a fluid connection between a pump outlet and a point upstream of the
3 electric heater.3. The system of Claim 1 wherein the means for regenerating comprises
4 a burner system.
- 1 4. The system of Claim 1 wherein the means for regenerating comprises a microwave
2 heating device.
- 1 5. The system of Claim 1 wherein the control means starts the regeneration process
2 *immediately* after the engine has stopped running.
- 1 6. The system of Claim 1 wherein the means for determining if the engine is on or off is
2 selected from one of the following: a) a switch b+, b) an oil pressure sensor or switch, c)
3 a speed or RPM sensor, d) a backpressure sensor or switch, e) a thermocouple located
4 in the exhaust stream, or f) any of combination of the above.

1 7. The system of Claim 1 further comprising a catalyst on the particulate control device
2 to allow for continuous regeneration of the device anytime the exhaust temperature is
3 sufficiently high.

1 8. The system of Claim 1 wherein the particulate control device comprises a diesel
2 particulate filter.

1 9. A method for regenerating a diesel particulate filter receiving exhaust from an engine,
2 the method comprising:
3 using a controller to automatically initiate a regeneration process upon a sensor
4 detecting that the engine has transitioned from an active state to a stopped state, and
5 suspending the regeneration process if the engine restarts during regeneration.

1 10. The method of Claim 9 further comprising restarting the regeneration process after
2 the suspending step.

1 11. The method of Claim 9 wherein the controller starts the regeneration process
2 *immediately* after the engine has stopped running.

1 12. The method of Claim 9 further comprising stopping the regeneration process after a
2 pre-determined amount of time.

1 13. The method of Claim 9 further comprising starting the regeneration process while
2 the filter is at an elevated temperature.

1 14. The method of Claim 9 further comprising using at least one bypass valve
2 positioned to direct exhaust flow away from the filter and into an alternative flow path
3 when the valve is open.

1 15. The method of Claim 9 wherein the sensor for determining if the engine is on or off
2 is selected from one of the following: a) a switch b+, b) an oil pressure sensor or switch,

3 c) a speed or RPM sensor, d) a backpressure sensor or switch, e) a thermocouple
4 located in the exhaust stream, or f) any of combination of the above.

1 16. A system for reducing particulate emissions from an internal combustion engine
2 comprising:

3 a particulate filter,
4 a regenerator configured to remove soot from the filter,
5 at least one sensor positioned to determine if the engine is operating, and
6 a control system with logic to automatically invoke a regeneration sequence after
7 every engine start and stop event.

1 17. The system of claim 16 wherein said regeneration sequence initiated, wherein the
2 filter remains at an elevated temperature within about 30 degrees C of exhaust
3 temperature at shutoff.

1 18. The system of claim 16 wherein said regeneration sequence initiated, wherein the
2 filter remains at an elevated temperature within about 20 degrees C of exhaust
3 temperature at shutoff.

1 19. The system of claim 16 wherein the contaminant remover is initiated immediately
2 after the engine stops.

1 20. The system of claim 16 wherein said regeneration sequence operates for an amount
2 of time sufficient, so that every time the engine is started, the filter will be substantially
3 free of soot.

1 21. The system of claim 16 further comprising a pressure switch or sensor to alert the
2 operator that excessive back pressure levels have been reached, signaling the need for
3 system inspection and service.

1 22. The system of claim 16 wherein the control system activates contaminant remover
2 after a selected time delay.

23. The system of claim 16 having at least one sensor positioned to determine if the engine is operating.

24. The system of claim 16 wherein said regeneration sequence operating for a time sufficient so that a level of particulate matter remaining in the filter causes the maximum particulate capture rate.

25. A system for reducing particulate emissions from an internal combustion engine said system comprising:

- a particulate filter,
- a contaminant remover configured to remove soot from the particulate filter, and
- a control system configured to automatically invoke a regeneration sequence after every engine start and stop event, and to interrupt the regeneration sequence if the engine restarts,

said regeneration sequence initiated, wherein the filter remains at an elevated temperature within about 30 degrees C of exhaust temperature at shutoff.

26. A system for reducing particulate emissions from an internal combustion engine comprising:

- at least one particulate control device,
- at least one inlet pipe,
- at least one outlet pipe coupled to the control device,
- piping to connect the engine and inlet pipe,
- means for regenerating the particulate control device in place while the engine is not operating,
- means for determining if the engine is operating,
- control means to start the means for regenerating, after the engine has stopped running,
- at least one bypass valve which direct the exhaust flow away from the particulate control device and into an alternative flow path when the valve is open, and
- control means to open and close the bypass valve.

1 27. The system of Claim 26 wherein the means for regenerating comprises an electric
2 heater, air pump, a fluid connection between a pump outlet and a point upstream of the
3 electric heater.

1 28. The system of Claim 26 wherein the means to regenerate comprises a burner
2 system.

1 29. The system of Claim 26 wherein the means to regenerate comprises a microwave
2 heating device.

1 30. The system of Claim 26 wherein exhaust gas from the engine has a temperature in
2 a range of about 170 to 270 °C.